# Use of Neuroform Stent in a Patient with Acute Stroke Caused by Spontaneous Petrous Segment Internal Carotid Artery Dissection. A Case Report

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**Key words:** arterial dissection, endovascular treatment

***Summary***

*Neuroform stents have been recently introduced for treatment of broad-necked intracranial aneurysms. Several studies have demonstrated the feasibility of deployment of Neuroform stents (Boston Scientific Target, USA) in intracranial circulation. We report a case of a patient presenting with acute stroke due to occlusive petrous segment internal carotid artery dissection who was treated with a Neuroform stent.*

## Introduction

Arterial dissection is recognised as an important cause of stroke especially in young patients. Most of them involve extracranial carotid and vertebral arteries. Spontaneous intracranial internal carotid artery (ICA) dissections are rare and most commonly affect supraclinoid ICA with or without extension into the middle and anterior cerebral arteries [1]. ICA dissections at the skull base are less common. Intra-cranial ICA dissections usually present with acute stroke with or without subarachnoid haemorrhage soon after onset of headache. Recent literature suggests that long-term prognosis of these patients is good with conservative treatment [1,2]. However, active/ invasive treatment has to be considered in certain unusual situations, which is illustrated by the case presented.

## Case Report

A 43-year-old left-handed male patient presented in September 2003 with sudden onset dense left haemiplegia (power grade 0/5), drowsiness and aphasia. A CT scan performed within three hours of onset of ictus showed no acute abnormality. A previously known cavernoma of the right mid-brain and thalamus and an old right cerebellar infarct were noted (figure 1A,B). A clinical diagnosis of acute right middle cerebral artery infarct was made and, given the patient's young age and absence of CT changes, a decision to proceed to catheter angiography was made with a view to performing thrombolysis.

Angiography demonstrated occlusion of the right internal carotid artery (ICA) from the level of the skull base with a tapered appearance of the proximal ICA typical of dissection (figure 2). Retrograde filling of the cavernous segment of the right ICA through the ophthalmic artery was noted (figure 3A) suggesting opening up of anastomosis between the external carotid branch and ophthalmic artery due to complete ICA occlusion. Poor collateral circulation through the circle of Willis, both from the left ICA and from the posterior circulation was also observed (figure 3B,C). There was also absence of significant pial collaterals.

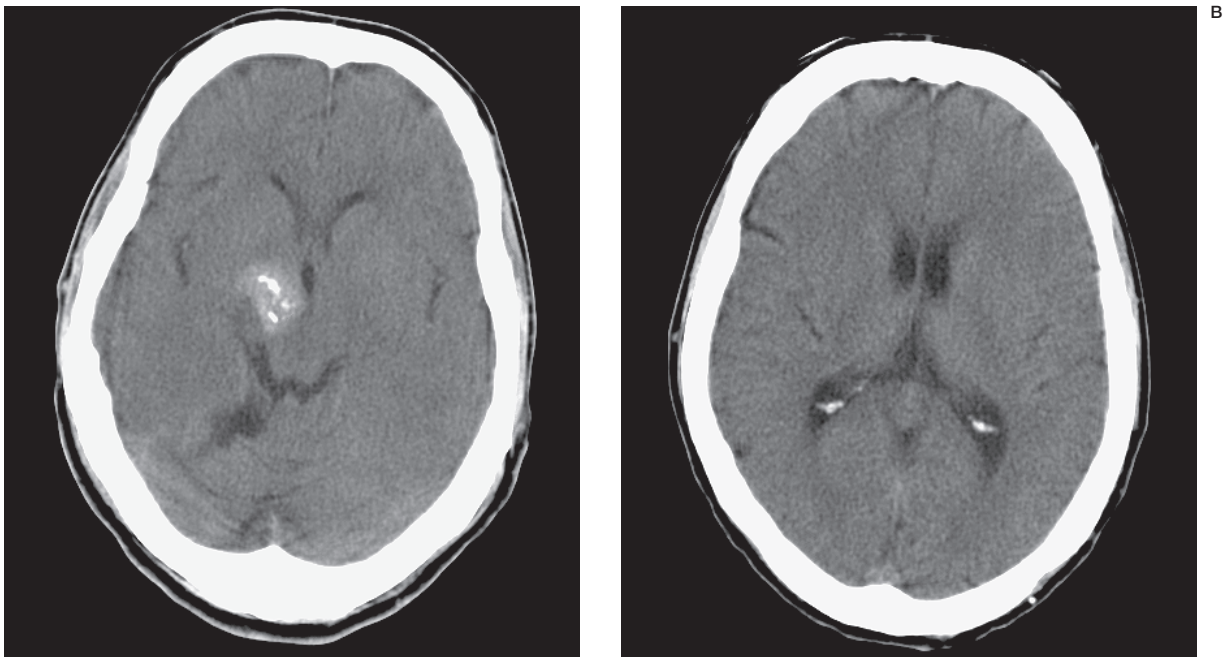



*Figure 1* A,B) CT scan showing a calcified cavernoma in the right thalamus and mid-brain. No evidence of infarction in the right middle cerebral artery territory is seen at this stage.

*Figure 2* Right common carotid artery angiogram demonstrates occlusion of the internal carotid artery with a tapered appearance of the vessel stump suggestive of a dissection.

Initially, difficulty was encountered in entering the true lumen of ICA in the dissected segment as the guidewire preferentially entered the false lumen. Eventually the true lumen was successfully entered with a Synchro 14 microguidewire (Boston Scientific Target, USA), which was then negotiated through the dissected petrous segment of the right ICA. A Tracker Excel 14 microcatheter (Boston Scientific Target, USA) was then introduced over the guidewire. This was followed by deployment of a Balance exchange microguidewire (Guidant, USA) which allowed the exchange of the microcatheter with the stent microdelivery catheter. Initially, a 4.5 mm x 15 mm Neuroform two stent was deployed in the distal part of the dissected segment. This was followed by deployment of an overlapping 4.5 mm x 20 mm Neuroform two stent to cover the rest of the dissected segment.

Angiogram following stent deployment demonstrated re-establishment of flow through the dissected segment of the right ICA with good filling of anterior and posterior cerebral arteries (figure 4). However, some of the right middle cerebral artery (MCA) branches were not filling (figure 5A,B). This was thought to be due to a thrombo-embolic complication. As the

time window of six hours (from the time of original ictus) for the use intra-arterial r-TPA had already elapsed at that stage, a decision was made to administer 10 mg of Abciximab IV over a period of one minute.

Following recovery from general anaesthesia, the patient was noted to have mild left facial weakness and grade 2/5 weakness of the left upper limb. The left lower limb weakness had resolved completely. A follow-up MRI and MR angiogram was performed two days later demonstrating normal arterial flow through the stented segment of the right ICA (figure 6) and normal filling of the previously occluded MCA branches (figure 7). The patient was transferred to a stroke unit for further recovery and rehabilitation. At the time of discharge the patient showed further improvement in the neurological deficits.

## Discussion

Cerebral infarction due to occlusive ICA dissection is rare. This is because there is generally good collateral circulation through circle of Willis and pial collateral vessels which maintain cerebral perfusion in the affected hemisphere in most cases.

We present an unusual case where cerebral circulation to most of the right cerebral hemisphere was severely compromised by a combination of occlusive dissection of right ICA and lack of collateral circulation. It is unlikely, therefore, that this patient would have been spared a massive infarction without invasive management and the consequent morbidity would have been made worse by the fact that the patient was left handed.

Thrombolysis, on its own, would have been ineffective in the presence of occlusive dissection. Decision to use a Neuroform stent was made in this context.

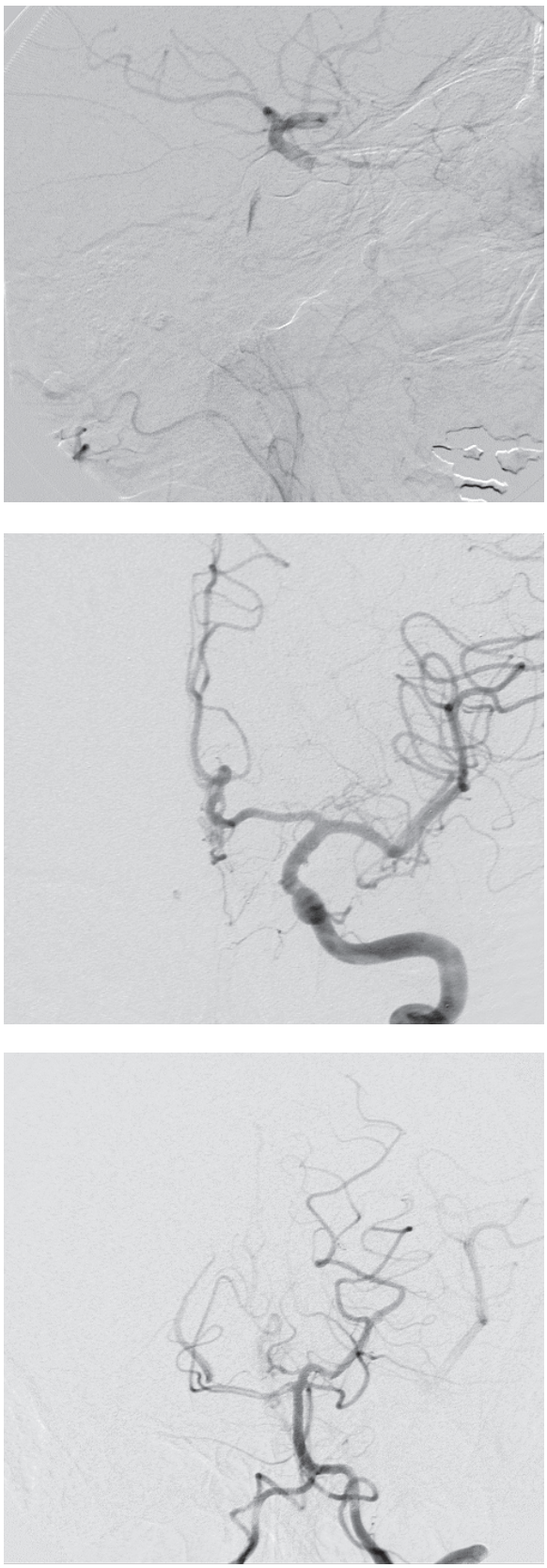



*Figure 3* A) Right common carotid angiogram demonstrated retrograde filling of the cavernous segment of the right internal carotid artery through the right ophthalmic artery. B) Left internal carotid artery angiogram showing no filling of the right sided vessels through the anterior communicating artery. Note also the absence of significant pial collaterals. C) Left vertebral angiogram showing absence of collateral supply to the right anterior circulation through posterior communicating artery.

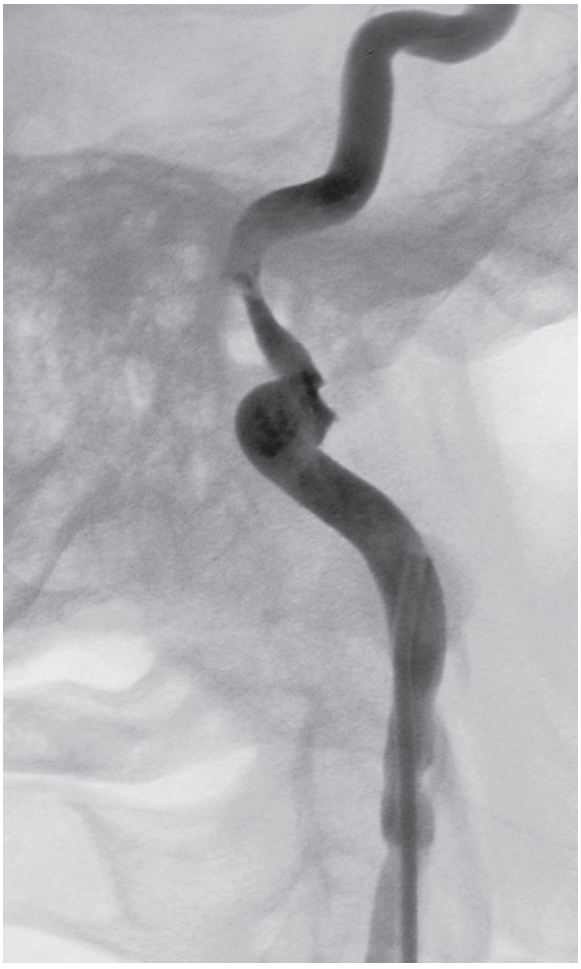
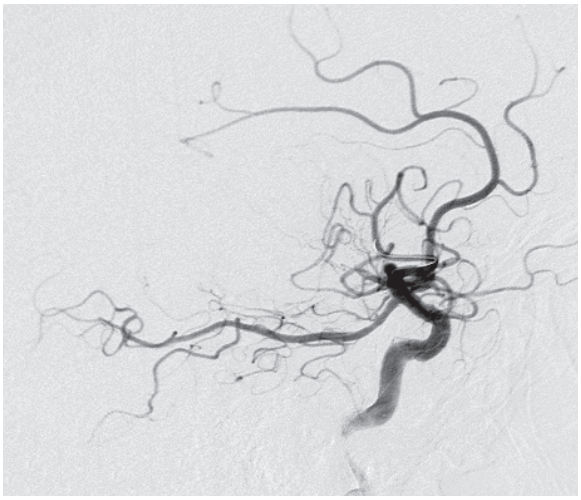


*Figure 4* Right internal carotid angiogram following deployment of the Neuroform 2 stents demonstrating re-establishment of flow through the dissected segment.

Neuroform stents are uncovered Nitinol stents which have been used in the treatment of broad-necked intra-cranial aneurysms [3,4]. The stent has increased flexibility compared to the previously available stents, which has resulted in improved navigation in the tortuous intracranial vessels. It is delivered through a microcatheter, which increases its ease of use. Furthermore, as these are self-expandable stents, there is less risk of vascular injury, which is associated with balloon-expandable stents [3]. Neuroform stents have limited radial strength and are therefore ineffective in treatment of atherosclerotic stenosis. However, in our own experience during combined stenting and coiling of a post-traumatic dissecting aneurysm of cervical vertebral artery (unpublished), the radial strength of the stent was found to be sufficient to expand stenotic dissected segment, even without the help of balloon angioplasty (complete occlusion of the dissecting aneurysm was obtained after the procedure, maintaining the patency of the parent vessel).

The greater flexibility of Neuroform stents makes them particularly suitable for use in dissection of intracranial vessels [6]. The dissected segment in the present case was in the petrous ICA rather than in the straight cervical ICA which is why Neuroform stent has been used instead of other stents more conventionally used in arterial dissection. Two Neuroform stents were used in this case as length of one stent was not sufficient to cover the entire dissected segment.

A



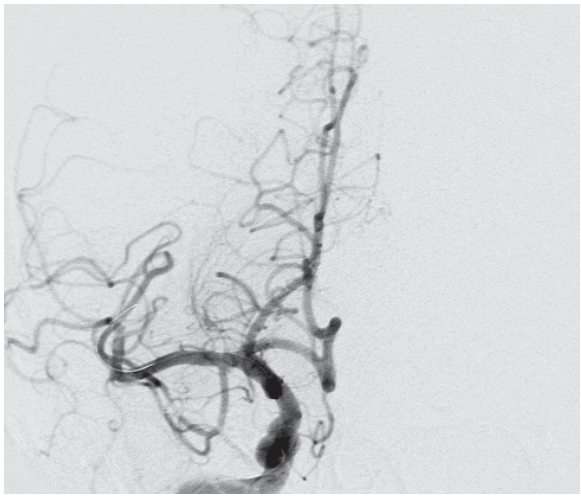


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*Figure 5* A,B) Right internal carotid angiogram (lateral and Towne's views) following stent deployment demonstrating good filling of the anterior cerebral artery branches but sub-optimal filling of some of the middle cerebral artery branches.

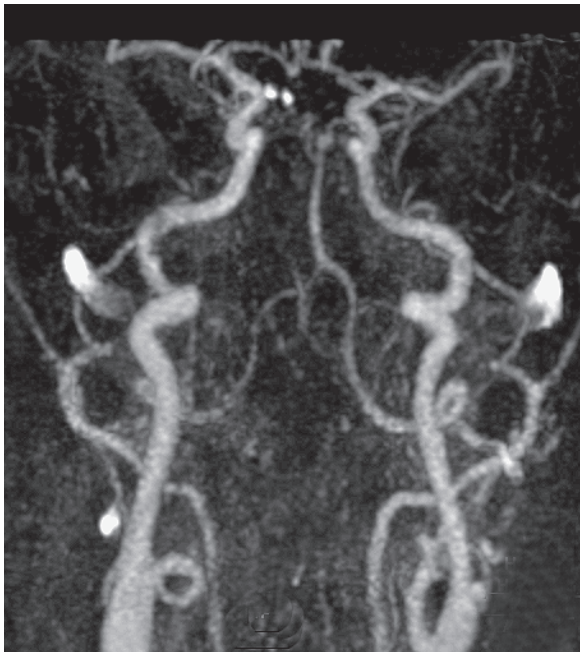

*Figure 6* Contrast enhanced MR angiogram two days post-stenting demonstrating normal blood flow through the stented segment in the petrous segment of the right internal carotid artery.

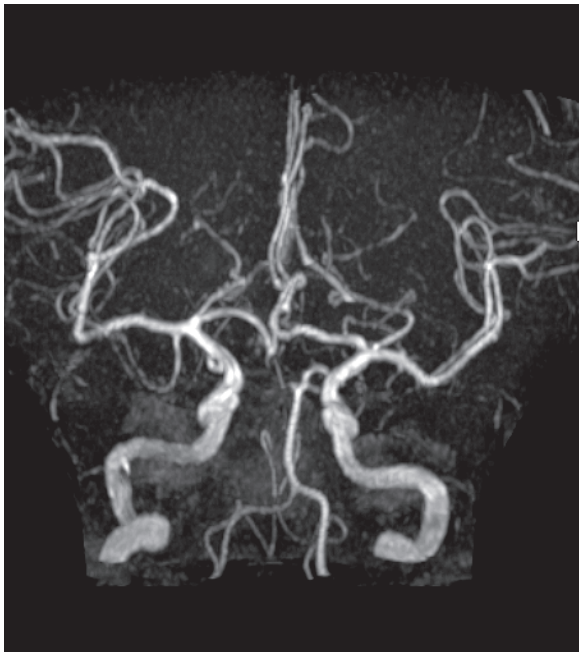

*Figure 7* Time of flight MR angiogram two days post-stenting demonstrating good flow in the distal middle cerebral artery branches on the right side.

Although there are several published reports of use of Neuroform stents in the treatment of dissecting aneurysms in both intra and extracranial carotid and vertebral arteries [5,6,7], there is, to our knowledge, no reported use of this stent in the setting of acute stroke caused by occlusive ICA dissection.

In the present case, Abciximab was used after demonstration of non-filling of some of the right MCA branches following stent deployment. Intra-arterial r-TPA was not used because, as per local and international guidelines [8], the time window for its use (i.e. six hours post ictus) had expired. Abciximab is a glycoprotein II b/III a receptor antagonist which prevents platelet aggregation and therefore effective in the treatment of platelet thrombi. IV Abciximab has been used for treatment of thromboembolic complication of endovascular procedures such as aneurysm embolization [9], although its role in management of acute cerebral infarction has not been established [8].

In our case, IV Abciximab was used with a view to lysing any residual platelet thrombus in the right MCA and to protect the stented segment of right ICA from thrombotic complications.

The excellent two day post- procedure MR angiographic result with good filling of the distal MCA branches suggests that Abciximab was effective in achieving both the objectives.

In our case, the decision to proceed to catheter angiography was made on the basis of the CT scan at presentation. This is in accordance with American Stroke Association recommendations [8]. Although we did not perform pre and post-procedure perfusion studies to demonstrate improvement in cerebral perfusion following stenting, the patient showed clinical improvement with resolution of left lower limb weakness and improvement of facial and left upper limb weakness. Both catheter angiogram and MR angiogram showed re-establishment of normal flow in the dissected ICA.

## Conclusions

Neuroform stents can be safely and effectively deployed in the intracranial circulation. Although the large majority of occlusive ICA dissections can be managed conservatively, Neuroform stents can be used to good effect in selected cases where active management is necessary.

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